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Quantum state and process tomography with entangled photons

Using a spontaneous parametric-downconversion source of photon pairs, we explore the creation of arbitrary 2-qubit quantum states. All physically allowable combinations of polarization entanglement and mixture can be produced, including maximally-entangled mixed states (MEMS).

The states are experimentally measured and refined via computer-automated quantum-state tomography. We are also investigating the possibility of "quantum transduction" – the transfer of a polarization qubit between photons of different frequencies. A storage cavity for photons is also under construction, for use in a new single-photon-on-demand scheme.